

Differentiation of the body build in judo competitors of the men's Polish national team

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Abstract

Background & Study Aim:

Anthropologists' research repeated for over half a century now prove that the body build constitutes one of the elements differentiating sportsmen from persons not carrying out a systematic physical training. However, in the population of sportsmen one deals with the accumulation two factors – features of persons selected to practise a particular sport (thus with the greatest predispositions) and the results of training. The aim of the study was to properties of the body build among judo competitors of the national team compared to persons of the same population not practising professional sport.

Material & Methods:

The study involved competitors from the Polish national team in men's judo (n=14). Competitors' age 20–30 (x=23 years), body mass 63 kg to 160 kg (x=93.8 kg), body height 166–197 cm (x=179.3 cm), training experience 13±4.2 years. The reference group was made up of students of Warsaw Technical University (Poland). Eighteen basic somatic features were measured. Slenderness, Rohrer's, BMI, and Manouvrier's indices were calculated. Body density, complete body fat, active tissue, overall profile of the body build and internal proportions of the body build were determined.

Results:

Weight categories (with the increase in body mass, a distinct decrease in slenderness features takes place) are an important factor determining morphological differentiation of judo competitors. Proportions of features of factors analysed internally show that competitors of all weight categories are characterised by particularly strong muscles of the forearm and weak ones of the shank.

Conclusions:

A selection of an appropriate technique of fight (throws, grips, feints and their combinations) to the body build and other components of the judo competitor's personality still remains an open issue. These problems must be tackled by coaches in reference to particular competitors individually.

Key words:

combat sports • fighting techniques • internal proportions • Perkal's method

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BACKGROUND

Anthropologists' research repeated for over half a century now prove that the body build constitutes one of the elements differentiating sportsmen from persons not carrying out a systematic physical training [1–9]. Dissimilarities in the body build – in many cases even extreme ones – also refer to sportsmen different with respect to the practised sports disciplines [10–12].

However, in the population of sportsmen one deals with the accumulation two factors – features of persons selected to practise a particular sport (thus with the greatest predispositions) and the results of training. The problem gains special significance in combat sports, where the division into weight categories is made [13–16] or technical specialisation i.e. in ju-jitsu two systems *Duo* and *Fighting* [7]. In the case of judo and wrestling, many specialist share an opinion that the type of competitors'

Duo (in ju-jitsu) – a prearranged sparring [5, p. 1].

Fighting system (in ju-jitsu) – an event is set in a competition: is composed of 3 parts: 1) blows/strikes and kicks, 2) throws, take downs, locks and strangulation, 3) Floor techniques, locks and strangulation [5, p. 2].

Fighting techniques (in the narrow sense) – is a use in the fight such sport technique, which due to the learned habits of movement simplify to achieve the purpose of fight or otherwise, it is the use of such, earlier did not practice motor solutions that fighting man considered at any given time as the best [41, p. 58].

body build is primarily connected with an individual style of conducting the fight, especially with the choice of the individual technique of fight [13,17,18]. However, there is a lack of one empirical proof that the body build determines that and no other choice of fighting techniques by a competitor (we leave aside the arbitrary coaches' decisions, which is a frequent practice, on which specific techniques to teach their competitors). There is also a lack of an unequivocal proof to confirm a rival thesis – that it is many years' repetitive training of specific fighting techniques that substantially modifies particular features of the body build.

Still, the results of hitherto research allow a conclusion that with extending the training experience a specific adaptation takes place, which is more clearly manifested by diminishing the differences in the body build than by a similarity in the level of sports mastery. For these reasons studies on adult sportsmen classified as the world elite in a particular sports discipline provide the most accurate information on characteristic properties of the body build stimulated by many-year influence of the training stimuli. Furthermore – the phenomenon is difficult to generalize. Empirical data prove that „super elite judo players” during World Championships and Olympic Games in 1995–2001 (during the period when there were no significant change of the judo competitions rules) used a larger number of throwing techniques from a group of „elite judo athletes”, used more diverse judo throws and more effectively [19]. It can be assumed that training of the super elite judokas is more differentiated (athletes repeat more fighting techniques). Thus, in their case an influence of unilateral stimuli is smaller, as is the case when multiple repetition of body movements determining the motor structure of a specific judo throw (i.e. *seoi nage*), which is the basis of a narrow technical specialization of the judo athletes.

Because in a global scale „super elite judo players” constitutes a few athletes from few countries, so the real, specific effects of adaptive judo training concerning the body build may be more visible in studies of individual national team players who are stimulated by similar stimuli.

The aim of the study was to properties of the body build among judo competitors of the national team compared to persons of the same population not practising professional sport.

MATERIAL AND METHODS

Participants

The study involved competitors from the Polish national team in men's judo (n=14). Competitors' age 20–30

(x=23 years), body mass 63 kg to 160 kg (x=93.8 kg), body height 166-197 cm (x=179.3 cm). The training experience was 13 ± 4.2 years and it was highly differentiated ($V_{\%} = 32.7$). For the sake of the study, the competitors were divided into three pre-arranged weight categories: *group 1 light* (n=4); *group 2 medium* (n=5); *group 3 heavy* (n=5). This division groups competitors from seven weight categories existing in judo. Thus, group 1 combines three categories (up to 60 kg, over 60 kg to 66 kg, over 66 kg to 73 kg), group 2 combines two (over 73 kg to 81 kg, over 81 kg to 90 kg), group 3 combines two (over 90 kg to 100 kg, over 100 kg). Argumentation of merging such weight categories is related to the practice of training. Most of athletes in general is exceeding the upper limit of the body weight in given weight category, reducing it for a few days before the competition.

Procedures and data handling and statistics

Anthropometric measurements (altogether 18 basic features) were conducted in consistence with adopted principles [20]. Furthermore, four indicators: slenderness, Rohrer's, BMI and Manouvrier's were calculated.

Tissue components were estimated on the basis of the determined body density: To calculate it, an indirect method was used – anthropometric assessment of body density on the basis of measuring subcutaneous fat, with the application of Piechaczek's [21] predicting equation: $D = 1.125180 - 0.000176 \cdot \log x_1 - 0.000185 \cdot \log x_2$ (where: D – body density; x_1 – fold thickness on the arm [log]; x_2 – fold thickness on the belly [log]).

Total body fat: in percentage of body mass (F%) was calculated by means of equation: $F\% = 100 (4.201/D - 3.813)$

Active tissue: in percentage of body mass: $T.A.\% = 100 - F\%$

Overall profile of body judokas' build was determined by means of standardized features: $Z = (x_i - \bar{x}) / SD_s$ (where: Z – standardized value; \bar{x}_i – average value of the judokas' group; \bar{x}_s – average value of the reference group; SD_s – standard deviation of the reference group).

The assessment of internal proportions of the body build was achieved by means of Perkal's [22] natural indicators with Milicerowa's modifications [23]. For this purpose the following were determined:

- Build factors m – through adding values standardized within each factor and dividing the sum by the number of features identifying the given factor. The fatty-layer factor, which is a standardized value of fat and skin folds was an exception: $Z = m$.

Table 1. Point scales of Perkal's natural indicators.

Points	Values of Perkal's natural indicators	
1	X to -1.07	values less than average
2	-1.06 to -0.57	
3	-0.56 to -0.18	average value
4	-0.19 to 0.18	
5	0.19 to 0.57	values greater than average
6	0.58 to 1.06	
7	1.07 to X	

- The indicator of the overall body size (M) of the group: $M = m_1 + m_2 + m_3 / 3$
- The assessment of the internal proportions of the body build as achieved by calculating Perkal's natural indicators for each factor of the build: $m_1 - M$; $m_2 - M$; $m_3 - M$
- The evenness of the build was determined by means of the intrapersonal variability indicator – the difference between the natural indicator of the highest numerical value and the natural indicator of the lowest numerical value.
- The code of internal group proportions on the basis of the point scale of Perkal's natural indicators (Table 1).
- The assessment of internal proportions of the features of the build within each of the factors was made by deducting the value of the m factor from the standardized features.

The method is not widely known in the English scientific literature. It was developed at a time when scientists behind the Iron Curtain had limited opportunities to publish articles in Anglo-Saxon journals [24]. But has the advantage that includes more indicators than the other popular methods of body composition assessment.

Differentiation of subjects within the individual characteristics (V) is expressed in a percentage.

The reference group was made up of students of Warsaw Technical University [25]. Numerous scientific publications [25–27] emphasise specific comparative values of this social group in studies on the body build of Polish sportsmen. Students of the Technical University are characterised by the greatest biological development (height and body mass) among Polish academic youth. Thus, it is the part of the population which constitutionally is the closest to sportsmen (who, as it is known, come from the most physically perfect youth). Hence, there is a possibility to accurately determine, in comparison to them, the effect of the influence of specific training stimuli on organisms of sportsmen who specialise in a particular discipline. In the presented body build profiles, the so-called zero line shows average values of students' features, whereas the distances from this like

measured by means of the value of standard deviation inform about the difference in the students' body build and that of judo competitors (identification of features characterising judo competitors' body build).

RESULTS

Mean values of the studied judo competitors prove that the slightest differentiation regards the body height in the sitting position ($V_{\%} = 4.08$) and in the body height while standing ($V_{\%} = 4.78$). The greatest variability was found in body mass ($V_{\%} = 29.63$) and BMI ($V_{\%} = 19.78$) and Rohrer's index ($V_{\%} = 15.93$). Competitors' immediate body dimensions increase together with weight categories, which is obvious (Table 2). Then the differences between competitors and the reference group do not appear in all cases with the same intensity (Figure 1).

Judokas of the heavy weight categories dominate other competitors and the reference group the most with regard to the body build (both height and mass) (Table 2, Figure 1). A characteristic feature of their body build is the forearm perimeter. In this respect they exceed judokas of medium weight categories by 1.72 of the standardised value (Z) and students by 4.49Z. They also exceed judokas of medium weight categories in the width of the knee by 2.59Z and students by 3.82Z. A characteristic feature of their body build is also a substantial perimeter of the shank and the width of the elbow (they exceed judokas of medium weight categories by 2.48Z and 1.1Z respectively and students by 3.02Z and 3.00Z). The shank perimeter of judokas of heavy weight categories is larger than that of the judokas of medium weight categories by 1.61Z and then the of students by 2.33Z. These competitors are characterised by a strong type of body build (according to slenderness index) and by the stout/obese one according to Rohrer's index. On the basis of Manouvrier's index judokas of heavy weight categories rank as long-legged. Their big fatty layer (22.78% of the body mass). The greatest differences in the body build of competitors of medium weight categories in comparison to those of light weight categories regard the forearm perimeter (in parentheses data regarding students): 2.01Z (2.77Z), elbow width 1.84Z (1.90Z), knee width 1.67Z (1.23Z), shoulder width 1.60Z (1.15Z). Judokas of light weight categories are characterised by a strong type of body build (according to slenderness index), by the stout/obese one according to Rohrer's index, and by an average length of lower limbs according to Manouvrier's index. The fatty layer in their body mass amounts to 15.6%. Body build of competitors of light weight categories is the closest to the reference group – standardized values are in a relatively narrow range between -0.86 and +0.75 (Figure 1). These competitors are the most distinctive

Table 2. Features of the body build of Polish men's judo representatives (n=14).

Features	Competitors from the adopted weight categories								
	light (n=4)			medium (n=5)			heavy (n=5)		
	X	SD	V	X	SD	V	X	SD	V
Standing body height	174.38	8.47	4.86	176.00	3.74	2.13	187.20	6.68	3.57
Sitting body height	91.13	3.35	3.68	93.25	2.90	3.11	97.70	2.02	2.07
Length of upper extremity	77.50	2.97	3.83	81.00	2.27	2.81	84.60	3.93	4.64
Length of lower extremity	83.25	5.55	6.66	82.75	4.09	4.95	89.50	5.61	6.27
Shoulder width	39.95	3.09	7.75	42.50	1.78	4.19	44.64	3.09	6.91
Pelvic width	27.93	1.49	5.34	29.50	0.41	1.38	30.54	1.35	4.43
Elbow width	7.00	0.41	5.83	7.63	0.25	3.28	8.00	0.35	4.42
Knee width	9.63	0.63	6.54	10.38	0.48	4.61	11.54	1.31	11.32
Forearm perimeter	27.38	0.25	0.91	31.00	0.91	2.94	34.10	1.14	3.34
Shank perimeter	35.80	2.35	6.57	38.13	1.60	4.20	43.80	2.59	5.91
Body mass	69.25	4.57	6.60	85.25	4.99	5.86	120.20	27.07	22.52
Fatty tissue,%	14.70	1.71	11.66	15.96	1.40	8.80	22.78	4.09	17.94
Active tissue,%	85.30	1.71	2.01	84.04	1.40	1.67	77.22	4.09	5.29
Body surface	1.84	0.10	5.62	2.05	0.06	3.09	2.50	0.32	12.92
Slenderness index	43.07	1.27	2.96	40.61	1.16	2.86	38.79	1.45	3.74
Rohrer's index	1.31	0.11	8.51	1.57	0.13	8.28	1.81	0.21	11.54
BMI index	22.79	1.00	4.40	27.55	1.94	7.04	33.98	5.13	15.10
Manouvrier's index	91.32	3.86	4.23	88.85	6.20	6.98	91.60	5.25	5.73

in their forearm perimeter 0.75Z, body height -0.85Z and height in the sitting position -0.89Z. Competitors of light weight categories are characterised by an overall smaller body build. They represent a medium type of body build (according to slenderness index), by the athletic/average type according to Rohrer's index. They are long-legged (according to Manouvrier's index) and with little fatty layer (14.7% of the body mass).

The analysis of standardized feature (Table 3) proves that competitors from the medium weight categories are characterised by a profile which is the closest to the reference group. Judokas from this group are the most different from students of the Technical University only with respect to the stoutness of the body build ($m_2=1.39$). Judokas from the heavy weight categories are significantly different from students with respect to fatty tissue ($m_3=5.82$), larger body dimension ($M=3.4$), stoutness ($m_2=3.04$), and also substantially in the length factor ($m_1=1.32$). Competitors from the light weight categories are characterised by generally smaller body dimensions than the reference group ($M=-1.19$) and length ($m_1=-0.62$), and most of all a low value of fatty tissue ($m_3=-2.79$).

The analysis of mutual proportions between factors of judokas' body build shows high differences resulting from belonging to a particular group of weight categories (Table 4). From among the studied competitors judokas from the medium weight categories are built the most proportionally (Figure 2). Despite this, the value of the intragroup variability (1.55) is quite significant (Table 4). Large stoutness and proportionally low values of length factors are distinctive elements of their body build. Fatty tissue is the most proportional to the overall body size. Competitors from the light weight categories are characterised by a much larger intragroup variability (2.65). The specificity of the body build of competitors from these weight categories lies in large stoutness (with the body size classified below the average), extremely low fatty tissue and the proportion of the length features to the overall body size. Still, the greatest specificity of the body build, with very high inter-individual differentiation (the index of intragroup variability is 4.49) characterises judokas from the group of heavy weight categories – overall body size, very large stoutness, extremely low length features (in proportion to the overall body size). On the other hand, stoutness

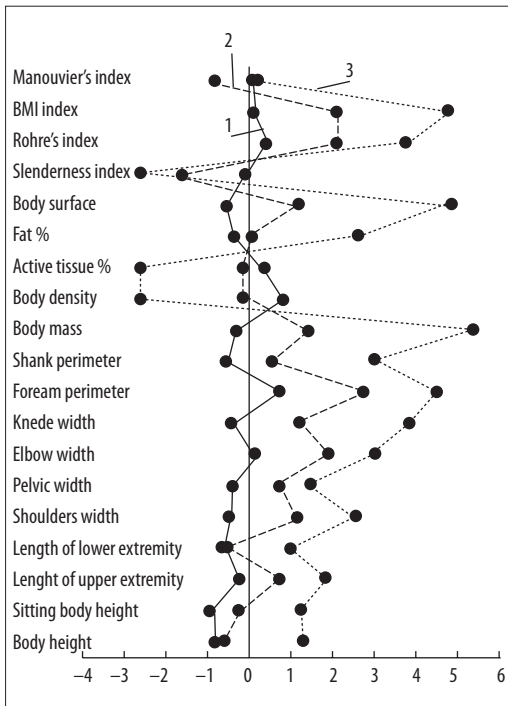


Figure 1. Profiles of the body build of Polish men's judo representatives (n=14) against a reference group. 1–3 numbers of weight categories: group 1 light (combines three categories: up to 60 kg, over 60 kg to 66 kg, over 66 kg to 73 kg); group 2 medium (combines two: over 73 kg to 81 kg, over 81 kg to 90 kg); group 3 heavy (combines two: over 90 kg to 100 kg, over 100 kg).

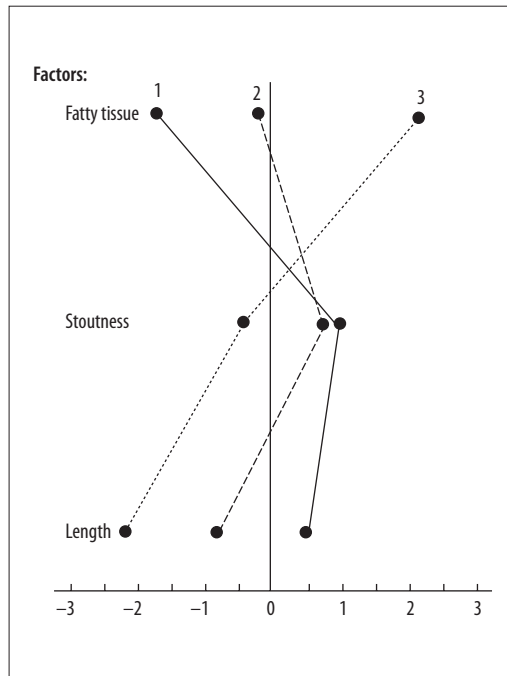


Figure 2. Natural indicators of the body build features of Polish men's judo representatives (n=14) against a reference group. 1–3 numbers of weight categories: group 1 light (combines three categories: up to 60 kg, over 60 kg to 66 kg, over 66 kg to 73 kg); group 2 medium (combines two: over 73 kg to 81 kg, over 81 kg to 90 kg); group 3 heavy (combines two: over 90 kg to 100 kg, over 100 kg).

Table 3. Standardised features of the body build of Polish men's judo representatives (n=14).

Factor	Competitors from the adopted weight categories		
	Light (n=4)	Medium (n=5)	Heavy (n=5)
Length m_1	-0.62	-0.16	1.32
Stoutness m_2	-0.15	1.39	3.04
Fatty tissue m_3	-2.79	0.42	5.82
Overall size index M	-1.19	0.55	3.4

Table 4. Internal proportions of the body build (Perkal's natural indicators) of Polish men's judo representatives (n=14).

Natural indicators	Competitors from the adopted weight categories		
	Light (n=4)	Medium (n=5)	Heavy (n=5)
Length	0.57	-0.71	-2.07
Stoutness	1.04	0.84	-0.35
Fatty tissue	-1.61	-0.13	2.42
Intra-individual (group) variability indicator	2.65	1.55	4.49

is the most proportional element in reference to the overall body size.

Natural indicators of somatic features (within three selected factors – length, stoutness and fatty tissue) enable a more in-depth analysis (Table 5). Judokas from all

Table 5. Natural indicators of the somatic features within the factors.

Factors	Somatic features	Competitors from the adopted weight categories		
		Light (n=4)	Medium (n=5)	Heavy (n=5)
Length	Standing body height	-0.19	-0.38	-0.05
	Sitting body height	-0.27	-0.04	-0.07
	Length of upper extremity	0.39	0.93	0.47
	Length of lower extremity	0.07	-0.51	0.34
Stoutness	Shoulder width	-0.30	-0.24	-0.54
	Pelvic width	-0.20	-0.66	-1.60
	Elbow width	0.21	0.51	-0.04
	Knee width	-0.28	-0.16	0.78
	Forearm perimeter	0.90	1.38	1.45
	Shank perimeter	-0.31	-0.84	-0.02
Fatty tissue	Sum of 3 skin-fat folds	-2.79	0.42	5.82

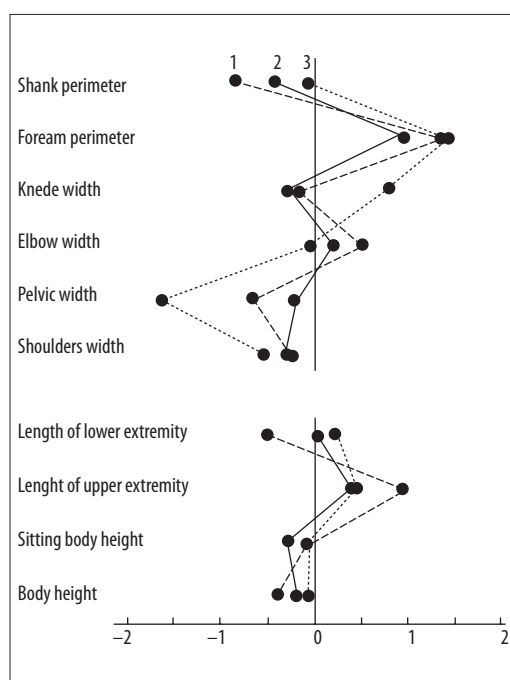


Figure 3. Natural indicators of the somatic features within factors, of Polish men’s judo representatives (n=14) against a reference group. 1–3 numbers of weight categories: group 1 light (combines three categories: up to 60 kg, over 60 kg to 66 kg, over 66 kg to 73 kg); group 2 medium (combines two: over 73 kg to 81 kg, over 81 kg to 90 kg); group 3 heavy (combines two: over 90 kg to 100 kg, over 100 kg).

weight categories are characterised by substantial musculature of forearms while weaker one of shanks. Among features referring to skeletal stoutness only among judokas of heavy weight categories was there a significant

advantage of the knee width and disproportionately – to the overall value of this factor – small hip width. Among competitors from the remaining weight categories these proportions are less upset (Figure 3). The advantage of the upper limb length over the body height (especially among judokas from the medium category) is slight.

The point scale of Perkal’s natural indicators (compiled in Table 1) enabled the classification of codes of internal proportions of the body build of judo competitors from three groups of weight categories. This code for competitors of light weight categories is 2-6-1, which means that the overall body size (M) is determined by: compared to other competitors a smaller length of the body and its parts, substantial stoutness, and extremely scanty fatty layer. The code for the internal proportions of the body build of competitors from medium weight categories is 2-6-4, and for the heavy weight ones 1-3-7.

DISCUSSION

The used Perkal’s method [22] with Milicerowa’s modifications [23] was created many years ago and is very laborious. However, due to repeated application of this method in the past, it is possible to compare the results of our research to the previously carried out studies. The use of this method has thus the primary advantage that in the recent years there have been significant changes in the training system, including the training of combat sports competitors. In that case the properties of the body build caused by more numerous and quality-changed training may be periodically verified by the same method. First of all, the effectiveness of the selection system for sport has improved. The proof

lies, among others, in the successes at the highest level of sports competition of sportsmen with relatively short training experience (usually accurate selection and obviously competently carried out sports training are decisive). In the case of short training experience it is difficult to claim that specific features of elite competitors' body build (that is of those with the greatest sports successes) mainly results from the influence of particular training loads. Hence, if a particular feature of the body build distinguishes both elite competitors with very long training experience and those with very short one, there are grounds to claim that this feature is significantly connected with the effectiveness of carried out fights. In some analyses, this indicator can be preferred to the correlation coefficients, whose value, though significant, is usually not high.

The method used in the studies on judokas from the Polish national team enables a comparison of their body build, among others, with wrestlers from nearly forty years ago [28]. It turns out that there are similar regularities in the body build between persons training judo nowadays and persons doing wrestling then (when judo was not so popular in Poland as it is today). Wrestlers at that time were characterised by – in comparison with the body height – short legs and a tendency to longer upper limbs. Tendencies to a relative advantage of the shoulder width over the hip width were also more frequent. Wrestlers' elbow was much more massive than the knee. The greatest diversification refers to the body perimeters. Wrestlers' arms and forearms were particularly muscular, thighs and hips relatively the least.

An advantage of the method used in our study is also a possible comparison of the results regarding the body build of judo competitors studied by means of other methods. Using Sheldon's method with Heath and Carter's modification [29] Carter [30] studied judo competitors participating in the Montreal Olympic Games. He found that the values of endomorphy (connected with the amount of fatty tissue), mesomorphy (connected with the amount of muscle mass) and ectomorphy (expressing the relation of body height to the body mass) amounted to 2.0-6.5-1.3, respectively. This proves that the then elite of world judokas were characterised by significantly lower fatty tissue and lower mesomorphy and ectomorphy than the compared competitors of the Hungarian national team. Still the general direction of the development of the body build of both groups of competitors was similar – good musculature with a low value of slenderness and slightly higher value of fatty tissue. Kawamura's et al. studies [31] confirmed high similarity between Japanese and Hungarian judokas. Furthermore, this team of scientists found that Japanese judo representatives in comparison to French

competitors were characterised by a more massive body build (the average value of the endomorphic component in Japanese judokas was higher than that of French judokas). Well-developed muscle tissue had a significant influence on the body mass of Japanese judokas (a high value of the mesomorphic component).

The presented here results of studies on judokas from the Polish national team conform observations from studies on 499 judokas – including participants of the World Championships [15]. The best Polish judokas, belonging to the world elite, can be distinguished at the background of other judokas by large massiveness of the body and small components indicating the level of slenderness. Probably, wider bone heads to which muscles with greater surface of cross-section are attached – and this determines a high level of mesomorphy – somehow affected the world championships participants' better use of their biological potential applied in fighting techniques (throws, grips, etc.). Competitors with higher levels of mesomorphy can develop greater acceleration and overcome greater external resistance. This factor may have a substantial influence on the effectiveness of a judo fight. The level of endomorphy in the best competitors remains in the low limits of the adopted standards, while it is characterised by very high values in competitors from heavy weight categories. In the case of the heaviest weight category (where there is no upper limit of the body mass) a high value of endomorphy may be an important asset. Finding these properties, among others, determines the sports successes in the competition at the country, continental and global scale.

Sterkowicz and Zarow's study results [2], regarding the characteristics of the somatic build of kyokushin karate competitors from the Polish national team ($n=13$), enable an interesting comparative study. The comparison of karatekas and judokas of light weight categories proves a high similarity of their body build (differences do not exceed one standardised value). The medium weight categories competitors of both disciplines already differ insofar as the studied somatic features. Karatekas exceed judokas in their body height ($\approx 1.5Z$) and the length of the lower limb ($\approx 1.5Z$), which was calculated as the difference between the body height in the standing position and its height in the sitting position. On the other hand, judokas exceed karatekas in elbow width ($\approx 1Z$), knee ($\approx 1Z$), forearm perimeter ($\approx 1Z$) and fatty tissue ($\approx 1.5Z$). The greatest differences, however, between judokas and karatekas, appear in heavy weight categories. Judokas notably ($\approx 2.5Z$) exceed karatekas in body stoutness (shoulder and knee width and forearm and shank perimeters) and the fatty tissue. They are no match for karatekas though in the length of lower limb, while

judokas exceed karatekas in the arm length. The specificity of sports activity justifies the found differences in body build. In judo a direct contact of fighting competitors depends on overcoming external resistance. Thus musculature is very important, and what follows considerable skeletal stoutness. In karate a greater role is played by these properties of the body build which enable more effective hits with limbs. Still, surprising may be the fact proving that at the national team level judokas exceed karatekas in arm length and not the other way round.

Very similar regularities were found while comparing the body build of women's Polish judo national team [6] with the women's Polish kyokushin karate national team [4]. For the scientific analysis the crucial element was the fact that in the studies on both men and women similar methodology was used. The results prove two important issues. Firstly, in the contemporary women's and men's judo similar criteria or selection and training methods are applied, but also in the contemporary women's and men's kyokushin karate similar criteria or selection and training methods are applied. Secondly, the analogies of similarities and differences in the relations "men's judo – men's kyokushin karate" and "women's judo – women's kyokushin karate" is an effect of a specific adaptation to these combat sports. Sterowicz-Przybycień [7] applied similar research methodology of the body build ju-jitsu athletes specialising in systems Duo and Fighting respectively. She found that specialization does not cause significant adaptive differences. However, both Duo and Fighting contestants differ many features of the body build from untrained students. The reference point in this study were also students of Warsaw Technical University.

Our study proved that men successful in judo differ in the body build from their peers not practising sport (reference to students of Warsaw Technical University). This regularity is confirmed by observations of Polish women training judo at a high level (national team) and

women not practising sport [6]. These are not, however, secluded observations. Claessens et al. [18] proved that Belgian judokas differ from 20-year-old Belgians not training sports in lower fatty tissue and better-developed musculature. One should keep distance to the results of studies on the relation between the body build of judo competitors with the sports results achieved by them. There are empirical data and theoretical concepts [32–36] proving that even the best motor preparation and the most perfect somatic conditions will not balance the shortcomings of the psyche of the person who must enter a close combat with another man.

It is worth to emphasize one more issue. In previous studies of young judokas well documented the development of the motor capacity [37–39]. A good example of the need and benefits of monitoring body build of young athletes since the start of the training are the conclusions of the studies Krstulović et al. [40].

CONCLUSIONS

In my opinion, the selection of an appropriate fighting technique (throws, grips, feints and their combinations) to the body build and other components of the judo competitor's personality will still remain an open issue. Such problems must be tackled by coaches in reference to particular competitors individually irrespective of whether they are going to cooperate with scientists or not.

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